

<p>Understand the concept of a linear or exponential function and use function notation. Recognize arithmetic and geometric sequences as examples of linear and exponential functions (F.IF.1-3)</p>	
<p><b>Standard I.F.IF.1:</b> Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y=f(x)</math>.</p>	
<p>Concepts and Skills to Master</p> <ul style="list-style-type: none"><li>Understand the definition of a function in terms of mapping elements from one set (domain) to another set (range).</li><li>Explain how a given representation of a function (graph, table, equation, context, geometric model) can be used to identify elements of the domain and corresponding elements of the range (<math>x, f(x)</math>).</li><li>Understand the graph of <math>f</math> is the graph of the equation <math>y=f(x)</math>.</li></ul>	
Related Standards: Current Course	Related Standards: Future Courses
All function standards (functions are used throughout high school mathematics courses), <a href="#">I.A.REI.10</a> , <a href="#">I.F.IF.5</a>	All function standards (functions are used throughout high school mathematics courses)

## Support for Teachers

Critical Background Knowledge
<ul style="list-style-type: none"><li>A function is a rule that assigns to each input exactly one output (<a href="#">8.F.1</a>)</li><li>Multiple representations (tables, graphs, equations, context, geometric models) (<a href="#">8.F.2</a>)</li></ul>
Academic Vocabulary
Domain, range, function, input, output, corresponding, set, element
Resources
<a href="http://www.uen.org/core/core.do?courseNum=5630#71625">Curriculum Resources</a> : <a href="http://www.uen.org/core/core.do?courseNum=5630#71625">http://www.uen.org/core/core.do?courseNum=5630#71625</a>

<p>Understand the concept of a linear or exponential function and use function notation. Recognize arithmetic and geometric sequences as examples of linear and exponential functions (F.IF.1-3)</p>	
<p><b>Standard I.F.IF.2:</b> Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p>	
<p><b>Concepts and Skills to Master</b></p> <ul style="list-style-type: none"><li>• Use function notation</li><li>• Evaluate functions, including functions created using arithmetic operations (example: <math>f(x) + g(x)</math> or <math>f(x) - g(x)</math>).</li><li>• Interpret statements that use function notation in terms of a context (example: given a context, explain <math>f(5) = 12</math> )</li></ul>	
Related Standards: Current Course	Related Standards: Future Courses
All function standards (function notation is used throughout high school mathematics courses)	All function standards (function notation is used throughout high school mathematics courses)

### Support for Teachers

Critical Background Knowledge
• Evaluate expressions ( <a href="#">6.EE.2c</a> )
Academic Vocabulary
Function notation, evaluate, input, domain, output, range
Resources
<a href="http://www.uen.org/core/core.do?courseNum=5630#71625">Curriculum Resources</a> : <a href="http://www.uen.org/core/core.do?courseNum=5630#71625">http://www.uen.org/core/core.do?courseNum=5630#71625</a>

Understand the concept of a linear or exponential function and use function notation. Recognize arithmetic and geometric sequences as examples of linear and exponential functions (F.IF.1-3)

**Standard I.F.IF.3:** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. Recognize arithmetic and geometric sequences as examples of linear and exponential functions. *For example, the Fibonacci sequence is defined recursively by  $f(0)=f(1)=1, f(n+1)=f(n)+f(n-1)$  for  $n \geq 1$ .*

#### Concepts and Skills to Master

- Recognize that sequences are functions (recognize the domain is the number of the term and the range is the value of the term).
- Define and express a recursive sequence as a function.
- Recognize that a sequence has a domain which is a subset of integers.

Related Standards: Current Course

[I.F.BF.1a](#), [I.F.BF.2](#), [I.F.LE.1](#), [I.F.LE.2](#)

Related Standards: Future Courses

[II.F.BF.1a](#), [III.A.SSE.4](#)

#### Support for Teachers

##### Critical Background Knowledge

- Use function notation ([I.F.IF.2](#))
- Understand definition of function ([8.F.1](#) and [I.F.IF.1](#))
- Recognize sequences (taught concurrently with [I.F.BF.1](#), [I.F.BF.2](#))

##### Academic Vocabulary

Recursive, sequence, functions, domain, range, subset, term

##### Resources

[Curriculum Resources](#): <http://www.uen.org/core/core.do?courseNum=5630#71625>

Interpret linear or exponential functions that arise in applications in terms of a context (F.IF.4-6)

**Standard I.F.IF.4:** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*

#### Concepts and Skills to Master

- Given a graph, identify key features including x- and y-intercepts; *intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
- Given a table of values, identify key features such as x- and y-intercepts; *intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
- Use key features to sketch a graph of the function.
- Use interval notation and symbols of inequality to communicate key features of graphs.

Related Standards: Current Course

[I.F.IF.6](#), [I.F.IF.7](#), [F.IF.9](#), [I.F.LE.1](#), [I.F.LE.3](#)

Related Standards: Future Courses

[II.F.IF.4](#), [II.F.IF.6](#), [II.F.IF.7](#), [II.F.IF.9](#), [II.F.LE.3](#), [III.F.IF.4](#), [III.F.IF.6](#), [III.F.IF.7](#)

#### Support for Teachers

##### Critical Background Knowledge

- Ability to graph a linear ([8.F.2](#)) or exponential function from a table or equation

##### Academic Vocabulary

Increasing, decreasing, positive, negative, intervals, intercepts, interval notation, maximum, minimum, symmetry, and end behavior

##### Resources

[Curriculum Resources](http://www.uen.org/core/core.do?courseNum=5630#71625): <http://www.uen.org/core/core.do?courseNum=5630#71625>

Interpret linear or exponential functions that arise in applications in terms of a context (F.IF.4-6)

**Standard I.F.IF.5:** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.

#### Concepts and Skills to Master

- Identify domain of a function from any representation.
- Relate the domain to context, explaining restrictions as a result of the context.

#### Related Standards: Current Course

[I.A.CED.2](#), All functions standards (domain is used throughout high school mathematics courses)

#### Related Standards: Future Courses

[II.A.CED.2](#), All functions standards (domain is used throughout high school mathematics courses)

### Support for Teachers

#### Critical Background Knowledge

- Familiarity with function notation and domain ([I.F.IF.2](#))
- Understand the definition of function ([8.F.1](#) and [I.F.IF.1](#))
- Independent, dependent variables and input/output ([8.F.1](#))

#### Academic Vocabulary

Domain, function

#### Resources

[Curriculum Resources](http://www.uen.org/core/core.do?courseNum=5630#71625): <http://www.uen.org/core/core.do?courseNum=5630#71625>

Interpret linear or exponential functions that arise in applications in terms of a context (F.IF.4-6)	
<b>Standard I.F.IF.6:</b> Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. 	
Concepts and Skills to Master	
<ul style="list-style-type: none"><li>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Focus on linear and exponential functions.</li><li>Estimate the rate of change from a graph.</li></ul>	
Related Standards: Current Course	Related Standards: Future Courses
<a href="#">I.F.IF.9</a> , <a href="#">I.F.LE.1</a> , <a href="#">I.F.LE.3</a> , <a href="#">I.S.ID.6</a> , <a href="#">I.S.ID.7</a>	<a href="#">II.F.IF.6</a> , <a href="#">II.F.IF.9</a> , <a href="#">II.F.LE.3</a> , <a href="#">III.F.IF.6</a> , <a href="#">III.F.IF.9</a> , <a href="#">III.F.LE.3</a>

## Support for Teachers

Critical Background Knowledge
<ul style="list-style-type: none"><li>Determine the rate of change from a description of a relationship or from two (x,y) values and interpret its meaning (<a href="#">8.F.4</a>)</li><li>Explain the slope <math>m</math> between any two points on a non-vertical line (<a href="#">8.EE.6</a>)</li></ul>
Academic Vocabulary
Average rate of change, interval
Resources
<a href="http://www.uen.org/core/core.do?courseNum=5630#71625">Curriculum Resources</a> : <a href="http://www.uen.org/core/core.do?courseNum=5630#71625">http://www.uen.org/core/core.do?courseNum=5630#71625</a>

**Analyze linear or exponential functions using different representations (F.IF.7,9)**

**Standard I.F.IF.7:** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. 

- a. Graph linear functions and show intercepts.
- e. Graph exponential functions, showing intercepts and end behavior.

**Concepts and Skills to Master**

- Given an equation of a linear or exponential function, create a graph by hand and show key features (intercepts, end behavior).
- Given an equation of a linear or exponential function, create a graph with technology and show key features (intercepts, end behavior).

**Related Standards: Current Course**

[I.F.IF.4](#), [I.F.IF.5](#), [I.F.IF.6](#), [I.A.REI.6](#), [I.A.REI.11](#), [I.A.REI.12](#), [I.F.BF.3](#)

**Related Standards: Future Courses**

[II.F.IF.4](#), [II.F.IF.7a, b](#), [III.F.IF.4](#), [III.F.IF.7b, c, d, e](#)

**Support for Teachers****Critical Background Knowledge**

- Graph linear functions ([8.EE.5](#), [8.F.3](#), and [8.F.5](#))

**Academic Vocabulary**

Linear, exponential, intercept, end behavior

**Resources**

[Curriculum Resources](#): <http://www.uen.org/core/core.do?courseNum=5630#71625>

Analyze linear or exponential functions using different representations (F.IF.7,9)	
<b>Standard I.F.IF.9:</b> Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, compare the growth of two linear functions, or two exponential functions such as <math>y=3^n</math> and <math>y=100 \cdot 2^n</math>.</i>	
Concepts and Skills to Master	
<ul style="list-style-type: none"><li>Compare properties of two functions, keeping the following in mind:<ul style="list-style-type: none"><li>properties include rate of change, intercepts, end behavior</li><li>function pairs include linear to linear, linear to exponential, exponential to exponential</li><li>representations include algebraically, graphically, numerically in tables, or by verbal descriptions</li></ul></li></ul>	
Related Standards: Current Course	Related Standards: Future Courses
<a href="#">I.F.IF.4</a> , <a href="#">I.F.IF.7</a> , <a href="#">I.F.LE.3</a> , <a href="#">I.S.ID.7</a>	<a href="#">II.F.IF.4</a> , <a href="#">II.F.IF.7</a> , <a href="#">II.F.LE.3</a> , <a href="#">III.F.IF.4</a> , <a href="#">III.F.IF.7</a> , <a href="#">III.F.LE.3</a>

## Support for Teachers

Critical Background Knowledge (Activating prior knowledge)
<ul style="list-style-type: none"><li>Compare properties of two functions (linear to linear), each represented in a different way (<a href="#">8.F.2</a>)</li><li>Interpret the equation of <math>y = mx+b</math> as defining a linear function (<a href="#">8.F.3</a>)</li><li>Construct a function, determine and interpret a rate of change and initial value of a linear function (<a href="#">8.F.4</a>)</li><li>Analyze graphs (increasing, decreasing, linear or nonlinear) (<a href="#">8.F.5</a>)</li></ul>
Academic Vocabulary
function, slope, rate of change, intercept, interval, growth rate
Resources
<a href="#">Curriculum Resources</a> : <a href="http://www.uen.org/core/core.do?courseNum=5630#71625">http://www.uen.org/core/core.do?courseNum=5630#71625</a>